

REMARKS

Claims 1-5, 7-12, 14, 15, and 17-19 are pending in the application. Claims 1, 8 and 15 are independent. By the foregoing Amendment, Applicants have amended claims 1, 8, and 15. Entry of this amendment and reconsideration of the pending claims are respectfully requested.

Claim Rejections – 35 U.S.C. § 103

Claims 1-3, 7-10, and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tan et al., US Patent 6,043,481 (hereinafter Tan) in view of Assadi et al., US Patent 6,166,369 (hereinafter Assadi) and further in view of Chang, US Patent Publication 2004/0147105 (hereinafter Chang).

Claims 4 and 11 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tan in view of Assadi, further in view of Chang, and further in view of Applicant's admitted prior art.

Claims 5 and 12 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tan in view of Assadi, further in view of Chang, and further in view of Nakai, US Patent 5,396,090 (hereinafter Nakai).

Claims 15 and 17-19 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Tan in view of Assadi, further in view of Chang, and further in view of Engelhardt et al., US Patent 6,387,773 (hereinafter Engelhardt).

When combining prior art elements to establish a prima facie case of obviousness, the MPEP requires a factual finding “...that the prior art include *each element claimed...*” M.P.E.P. § 2143 (A)(1). “All words in a claim must be considered in judging the patentability of that claim against the prior art.” M.P.E.P. § 2143.03.

Amended claim 1 recites,

An image sensor comprising:
a plurality of pixels formed in a semiconductor substrate, each pixel including a light sensitive element;
a micro-lens over each of said light sensitive elements; and
a layer of oxide disposed between the light sensitive elements and the micro-lenses, *wherein the layer of oxide*

includes a horizontal top surface and raised ridge structures formed from the layer of oxide extending above the horizontal top surface and surrounding each of said micro-lenses, wherein each said raised ridge structure has a triangular cross-section and at least partially supports said micro-lens, wherein the micro-lens overlays a base portion of the raised ridge structure such that a maximum width of the micro-lens is greater than a width of the micro-lens at the horizontal top surface of the layer of oxide.

Thus, amended claim 1 includes a layer of oxide that includes a horizontal top surface, where a maximum width of the micro-lens is greater than a width of the micro-lens at the horizontal top surface of the layer of oxide. Applicant respectfully submits that Tan, Assadi, and Chang whether taken individually or in combination fail to disclose, teach, or suggest at least this expressly recited feature, as is more fully explained below.

First, the December 29, 2010 Office action cites to ridge elements 19 of Tan as allegedly disclosing Applicants' claimed raised ridge structure. In particular, page 3 of the office action states "*the Tan reference teaches...wherein each said raised ridge structure (19) at least partially supports the micro-lens (as shown in Fig. 9b), wherein the micro-lens (18) overlays a base portion of the raised ridge structure (19). Please refer to Figs. 4 and 9b, and Col. 3, Lines 35 - Col. 4, lines 10.*" Applicant respectfully disagrees and maintains that Tan fails to disclose that any portion of Tan's micro-lens elements 18 "overlays" any portion of Tan's ridge elements 19. Nevertheless, in the interest of expediting a timely notice of allowance, Applicant has amended claim 1 as listed above, to further recite that the layer of oxide includes a horizontal top surface where the raised ridge structures extend above the horizontal top surface and where the micro-lens have a **maximum width that is greater than a width of the micro-lens at the horizontal top surface**. Applicant submits that a fair reading of Tan reveals that a width of Tan's micro-lens element 18 at the horizontal surface of transmissive intermediate layer 16, on which micro-lens element 18 is disposed, is indeed the maximum width of micro-lens element 18. Stated another way, **Tan fails to disclose, teach or suggest that micro-lens element 18 includes a maximum width that is greater than a width of the micro-lens at the surface of transmissive intermediate layer 16.**

None of the remaining cited references, including Assadi, Chang, Nakai, nor Engelhardt cure this deficiency of Tan. For example, FIG. 3 of Assadi clearly illustrates that the width of microlens 24 at the surface of color filter array 16 is also the maximum width of microlens 24. Similarly, Chang illustrates in FIG. 9 that the width of microlens layers 24a, 24b, and 24c at the surface of spacer layer 22 is the maximum width of the microlens layers.

Second, pages 3 and 4 of the December 29, 2011 Office action alleges that “*It would have been obvious to one of ordinary skill in the art at the time the invention was made to have included the raised ridge structure having a triangular cross-section, as taught by Assadi, with the image sensor of Tan.*” Applicant respectfully disagrees. In fact, Applicant asserts that Assadi **teaches away** from the suggested combination with Tan. To be sure, an inference of nonobviousness is especially strong where the prior art’s teachings undermine the very reason being proffered as to why a person of ordinary skill would have combined the known elements. *Deputy v. Medtronic Sofamor Danek*, 526 F. Supp. 2d 162 (D. Mass. 2007).

By way of review, Tan discloses a method for forming the raised ridge structure that includes the step of transferring surface contours of the photoresist layer to the spacer layer using “**reactive ion etching**” (step 35 in Fig. 9A). See, Col. 4, Line 60 – Col. 5, Line 29. On the other hand, Assadi discloses that the raised ridges are formed from hybrid sol-gel glass using techniques comparable to that utilized in connection with forming photoresist (i.e., UV photolithography). Thus, there is no “reactive ion etching” involved to form the raised ridge of Assadi. See, Col. 2, Lines 54-61; Col. 3, Lines 24-37. In fact, Assadi expressly states,

Advantageously, the reflective surfaces 12 may be formed by a hybrid sol-gel glass. The hybrid sol-gel glass can be formed **using low temperature formation processes**. Thus, the glasses may be shaped and formed using techniques comparable to that utilized in connection with forming photoresists. That is, UV light may be used to expose a portion of the sol-gel material and to develop that material so that the remaining portion may be removed.

Thus, Assadi teaches the use of a hybrid sol-gel glass because the hybrid sol-gel glass can be **advantageously formed using low temperature formation process**. However,

as would be understood by one of ordinary skill in the art, "reactive ion etching" is not a low temperature process. Thus, Assadi's expressly stated advantage of low temperature formation is lost. Accordingly, Assadi teaches away from the formation process that includes "reactive ion etching".

Therefore, the cited references fail to disclose, teach or suggest each element of claim 1, as required under M.P.E.P. §2143. Independent claims 8 and 15 includes similar nonobvious elements as independent claim 1. Applicants respectfully request that the §103(a) rejections of claims 1, 8, and 15 be withdrawn.

The remaining dependent claims are nonobvious over the cited references for at least the same reasons as discussed above in connection with their respective independent claims, in addition to adding further limitations of their own. Accordingly, Applicants respectfully request that the instant § 103 rejections of the dependent claims also be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants believe the applicable rejections have been overcome and all claims remaining in the application are presently in condition for allowance. Accordingly, favorable consideration and a Notice of Allowance are earnestly solicited. The Examiner is invited to telephone the undersigned representative at (206) 292-8600 if the Examiner believes that an interview might be useful for any reason.

CHARGE DEPOSIT ACCOUNT

It is not believed that extensions of time are required beyond those that may otherwise be provided for in documents accompanying this paper. However, if additional extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a). Any fees required therefore are hereby authorized to be charged to Deposit Account No. 02-2666. Please credit any overpayment to the same deposit account.

Respectfully submitted,
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